

~~07-05-2004~~

11/7/2003

CENTRAL CONTROL SYSTEM FOR CONTROLLING MULTIPLE AIR
CONDITIONERS AND METHOD FOR OPERATING THE SAME

BACKGROUND OF THE INVENTION

5

Field of the Invention

The present invention relates to a central control system for controlling multiple air conditioners and a method for operating the same, and more particularly to a central control system for controlling multiple air conditioners and a method for operating the same, which can control the multiple air conditioners in a central control manner by operating a central controller connected to the multiple air conditioners through a dedicated line based on an air conditioner communication protocol and perform a communication protocol conversion such that the multiple air conditioners can be remotely controlled through an external Internet network based on an Ethernet communication protocol.

10

15

20

Description of the Related Art

The configuration of a conventional system for controlling multiple air conditioners will be described in detail with reference to Fig. 1.

25

A multi-air conditioner system is made up of a single outdoor device 20 and a plurality of indoor devices 10. Since

the respective indoor devices can simultaneously perform cooling operations and some of the indoor devices can perform cooling operations, the multi-air conditioner system is cost-effective and efficient. In general, the single outdoor device and the indoor devices connected to the single outdoor are installed in every room (or every office room) within a building. In the case of a large-sized multistory building, the outdoor and indoor devices are installed on every story.

In order for the multiple air conditioners to partially or entirely perform cooling operations, the outdoor device must individually control operating states of the indoor devices connected to the outdoor device. Thus, if a user inputs a cooling operation command into one indoor device, the outdoor device connected to the indoor device identifies what kind of a cooling operation command is inputted into which indoor device and adjusts coolant circulation, thereby performing a cooling operation corresponding to the cooling operation command.

However, if errors are detected from the indoor devices in the conventional multi-air conditioner system, a manager must move to the indoor devices or the outdoor device connected to the indoor devices and then input a control command for repairing and maintenance into the indoor devices or the outdoor device as shown in Fig. 1. Where a plurality of outdoor devices are installed at each of stories within a large-sized building, respectively, there is a disadvantage in that

manpower and cost for managing the outdoor devices increase significantly.

As a central controller connected to the outdoor devices is additionally installed to control the outdoor devices, the manager can control the outdoor devices and indoor devices connected to an outdoor device in a central control manner without accessing each outdoor device. However, because the central controller can only perform a function of a simple command input such as a power on/off command input, etc. and an identification function, there is a problem in that all sorts of details associated with the outdoor and indoor devices cannot be controlled.

Moreover, where the central controller is connected to the external Internet network, because a communication protocol of a signal transmitted and received through the Internet network is different from that of a signal that can be recognized by the multiple air conditioners, a control command inputted by a remote control operator accessing the external Internet network cannot be recognized by the multiple air conditioners and hence the multiple air conditioners cannot be remotely controlled.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in view

of the above problems, and it is an object of the present invention to provide a central control system for controlling multiple air conditioners and a method for operating the same, which can stably and remotely control the multiple air conditioners by exchanging signals of different communication protocols through a central controller such that the signals can be smoothly exchanged between the multiple air conditioners and a remote controller, wherein the multiple air conditioners transmit and receive signals based on an air conditioner communication protocol between outdoor and indoor devices and a remote controller receives a control command signal based on an Ethernet communication protocol through an external Internet network.

In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a central control system for controlling multiple air conditioners, comprising: the multiple air conditioners configured by a plurality of indoor devices and an outdoor device; a central controller connected to the multiple air conditioners through a dedicated line based on an air conditioner communication protocol for receiving a control command to control the multiple air conditioners in a central control manner, the central controller being connected to an external Internet network based on an Ethernet communication protocol to receive a control command such that the multiple

air conditioners can be remotely controlled; and a protocol converter for carrying out a communication protocol conversion for a signal such that the control command inputted at a remote site can be transmitted to the multiple air conditioners through the Internet network.

In accordance with another aspect of the present invention, there is provided a method for operating a central control system for multiple air conditioners, comprising the steps of: (a) transmitting a control command inputted from a remote controller capable of accessing an Internet network to the multiple air conditioners installed indoors; (b) after the control command is converted into a control command based on an air conditioner communication protocol, transmitting the control command based on the air conditioner communication protocol to the multiple air conditioners; and (c) allowing the multiple air conditioners to perform a control operation in response to the control command based on the air conditioner communication protocol and to transmit data of control states to the remote controller.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in

conjunction with the accompanying drawings, in which:

Fig. 1 is a view illustrating a conventional system for controlling multiple air conditioners;

5 Fig. 2 is a view illustrating the configuration of a central control system for controlling multiple air conditioners in accordance with the present invention;

Fig. 3 is a view illustrating an internal configuration of the central control system for controlling the multiple air conditioners in accordance with the present invention; and

10 Fig. 4 is a flowchart illustrating a method for operating the central control system for the multiple air conditioners in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

15 Fig. 2 is a view illustrating the configuration of a central control system for controlling multiple air conditioners in accordance with the present invention; and Fig. 3 is a view illustrating an internal configuration of the
20 central control system for controlling the multiple air conditioners in accordance with the present invention. The present invention will be described in detail with reference to Figs. 2 and 3.

25 In the multiple air conditioners 250 in accordance with the present invention, an outdoor device 200 is connected with

a plurality of indoor devices 100. Thus, when the multiple air conditioners 250 are installed, there are advantages in that the utility of an installation space is excellent and installation cost is reduced. Moreover, because one outdoor device operates in conjunction with the indoor devices, power consumption is reduced and hence energy efficiency is excellent.

The outdoor device 200 includes a condenser for changing a coolant of a high-temperature and high-pressure gas state to a coolant of a liquid state. In the outdoor device 200, a compressor performs heat exchange with a gas coolant and outdoor air while the high-temperature and high-pressure gas coolant passes through the outdoor device, thereby forming a medium-temperature and high-pressure liquid coolant according to a condensation phenomenon. The outdoor device 200 includes an outdoor fan unit with an outdoor fan and a motor for ventilating air to the outdoor device 200 and increasing the efficiency of heat exchange.

If the medium-temperature and high-pressure liquid coolant is expanded by an expansion valve and hence a low-temperature and low-pressure liquid coolant passes through the indoor device 100, the liquid coolant absorbs heat from indoor air and is vaporized according to a vaporization phenomenon. At this time, a temperature of the indoor air is lowered, so that an indoor cooling operation is performed. Thus, the

indoor device 100 includes an indoor fan unit with a motor and an indoor fan for ventilating hot or cool air indoors, etc.

The indoor devices 100 are installed at a designated place within a building. The indoor devices 100 is connected and networked to a dedicated line on the basis of an RS-485 communication protocol. Thus, the outdoor device 200 can manage control states of the indoor devices connected to the outdoor device 200. The outdoor device 200 receives a control command, adjusts circulation of a coolant and transmits the control command to a corresponding indoor device 100.

Here, RS-485 is a communication protocol used for a multi-point communication line as a kind of a serial communication interface protocol. The RS-485 supports up to 32 nodes per line because it uses lower-impedance drivers and receivers. In relation to the RS-485, a transmission distance depends upon a transmission rate but data can be transmitted up to a maximum distance of 1200m. The RS-485 communication protocol is referred to as an air conditioner communication protocol.

Where a large number of indoor devices are installed within a large-sized building, a plurality of outdoor devices 200 are connected to the indoor devices through the dedicated line. The outdoor devices 200 are connected to a central controller 300 through the dedicated line.

Because the central controller 300 controls the outdoor

devices 200, and the outdoor devices 200 controls the indoor devices 100, a system manager managing air conditioning operates the central controller 300 and controls the multi-air conditioner system in a central control manner.

5 The central controller 300 transmits and receives signals based on the air conditioner communication protocol. Internally, the central controller 300 can not only control the multiple air conditioners 250 in the central control manner, but also access an Internet network I based on an
10 Ethernet communication protocol. Where remotely controlling the indoor devices, a remote controller C can access the central controller 300 through the Internet network I.

A control command can be inputted to the multi-air conditioner system 250 through the central controller 300 at a
15 remote site. Moreover, states of the multiple air conditioners can be monitored at the remote site, and data indicating a result of the control corresponding to the control command can be identified at the remote site.

To perform the above-described functions, a
20 communication protocol conversion is needed for signals transmitted and received between the Ethernet communication protocol (TCP/IP) and the air conditioner communication protocol (RS-485). To carry out the communication protocol conversion, a protocol converter 400 is connected to a serial
25 port of the central controller 300 in serial (RS-232). Then, a

communication protocol conversion for the control command inputted through the Internet network at the remote site is performed such that the control command can be recognized by the multiple air conditioners 250. The communication protocol conversion for the data of the result of the control associated with the multiple air conditioners 250 is performed such that the data can be identified through the remote controller C.

The Ethernet is a local network capable of exchanging information between a maximum number of 1,024 points at a transmission rate of 10Mbps within about 2.5km, i.e., a LAN (Local Area Network). TCP/IP is used in the LAN.

The central controller 300 includes a signal storage unit 310 for storing a remote control command received through the Internet network I; an Internet data storage unit 320 for storing Internet access port data set to access the external Internet network and IP address data; and a controller 330 for controlling a flow of signals transmitted and received through the Internet network and controlling the protocol converter 400 such that the communication protocol conversion for a signal can be performed.

The central controller 300 further includes a key input unit 301 for receiving a control command such that the multiple air conditioners can be controlled and an output unit 302 for outputting state data of the multiple air conditioners

operated according to the control command.

The central controller 300 includes a control program driver 303 for driving a control program implemented by a GUI (Graphic User Interface) in order to conveniently control the multiple air conditioners 250. Where the remote controller capable of inputting a control command at the remote site sends an air conditioner control request, the controller 300 includes a control program transmitter 304 for transmitting the control program such that the control program for controlling the multiple air conditioners can be downloaded through a web browser of the remote controller.

That is, the indoor devices 100 and the outdoor devices 200 are connected to a network using the RS-485 protocol. The central controller 300 is connected to the multiple air conditioners through a dedicated line and simultaneously connected to the external Internet network using the Ethernet communication protocol. Thus, the manager can not only control the outdoor devices 200 using the central controller 300 in the central control manner, but also perform a remote control operation through the Internet network I.

Fig. 4 is a flowchart illustrating a method for operating the central control system for controlling the multiple air conditioners in accordance with the present invention.

As shown in Fig. 4, the remote controller connectable to the Internet network is operated and a control command as an

Ethernet communication protocol signal for multiple air conditioners is inputted (S1). The control command as the Ethernet communication protocol signal is transmitted to the protocol converter through the Internet network. After receiving the control command, the protocol converter stores the control command in a buffer (S2), converts the control command based on the Ethernet communication protocol into a control command based on an air conditioner communication protocol (S3), and transmits the control command based on the air conditioner communication protocol to the multiple air conditioners (S4).

After receiving the control command and performing control operations (S5), the multiple air conditioners generate data of control states and transmit the control state data to the protocol converter through the dedicated line (S6). The control state data is a signal based on the air conditioner communication protocol.

The protocol converter receives the control state data, stores the control state data in the buffer (S7), converts the control state data of the communication protocol into control state data of the Ethernet communication protocol (S8) and transmits the control state data to the remote controller (S9).

As the remote controller receiving the control state data through the Internet network externally outputs a result of the control, a control operator, who inputted the control

command at the remote site, can identify the result of the control associated with the multiple air conditioners (S10).

As apparent from the above description, the present invention provides a central control system for controlling multiple air conditioners and a method for operating the same, which can control the multiple air conditioners connected through a dedicated line based on an air conditioner communication protocol using a central controller, reduce manpower and waste of time for controlling and managing the multiple air conditioners through a remote control manner, and improve the stability and reliability of an air conditioner control operation by converting a remote control command based on an Ethernet communication protocol transmitted and received through an Internet network into a control command based on an air conditioner communication protocol such that the control command can be recognized by the multiple air conditioners.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.